SELECTED TOPICS

In Aerospace Engineering

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28.1. Introduction

Numerical improvements of the double lattice method (DLM) are presented in this chapter. The improvements are applied to two types of lifting surface configurations, including the planar lifting surface and the non-planar lifting surface configurations. The numerical singularity problem of both configurations are first identified, and the solution procedures are described and compared with the original solution of Albano and Rodden [2] and with its refinement solution proposed by Rodden, Giesing and Kalman [30].

28.2. Present DLM for Planar Lifting Surfaces

The basic concepts of the original DLM are used here. The surfaces are divided into small trapezoidal elements as shown in Fig. 33.1. The lifting pressure is assumed to be concentrated at the doublet lifting line located at the quarter chord of each panel. The control point is placed on the three-quarter chord at mid-span of each element.

If the doublet lifting line and the control point are located at elements i and j respectively, then the aerodynamic operator may be written as:

$$\Im_{ij}=\frac{\Delta x_s}{8\pi}\int_e K\left(x_i-\xi_j, y_i-\eta_j, z_i-\zeta_j, k, M\right)d\eta \tag{28.1}$$

In the original DLM, the numerical integration of the kernel function K is based on the quadratic approximation of the numerator as shown in [2]. In the present work, the integration procedures are based on the following procedure: